

between said electrically conductive enclosure and said electrode, said material to be processed being in contact with said electrode;

wherein a gas containing a majority of inert gas is introduced into said inlet for gas and a radio-frequency voltage applied between said electrically conductive enclosure and said electrode creates an atmospheric pressure plasma in said interior space for processing said material to be processed as it passes through said electrically conductive enclosure.

Claim 12 (Amended) The apparatus as described in Claim 9, wherein said gas is comprised of said inert gas and a chemically reactive gas.

IN THE SPECIFICATION:

Page 9, lines 15-28: It is important to note that inasmuch as the present invention utilizes RF energy to create a plasma and to process materials, electrically conductive enclosure 11 does not necessarily need to be grounded. In some circumstances it may be desirable to have electrically conductive enclosure 11 floating and apply RF energy 15 at some predetermined phase, which can differ by as much as 180°, with respect to RF energy 16 applied to electrode 13, to enhance the effectiveness of the processing. In this situation, a protective, grounded casing 14, shown by dashed lines in Figure 1, would enclose the invention for safety reasons. An appropriate frequency for the RF energy used in the present invention is 13.56 Megahertz (MHz), however other RF frequencies might also prove useful.

REMARKS

Reconsideration of the above-referenced application is respectfully requested.

The applicants appreciate the Examiner's statement that Claims 7,8,16 and 17 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. However, applicants are of the opinion that, as amended, all of their claims should be allowable

The Examiner initially objected to the drawings under 37 CFR 1.83(a) for failing to show the first and second RF energies, described as first and second radio frequency voltages in Claims 7 and 16 (Amended). A Proposed Drawing Correction is being submitted contemporaneously that illustrates in red the first and second radio frequency voltages. Additionally, the specification has been amended to insert item numbers for the RF energies.

Next, the Examiner rejected Claims 1-6 and 9-15 under 35 U.S.C. §102(b) as being anticipated by the Wooley et al. patent (U.S. Patent No. 5,743,966). The applicants respectfully traverse this rejection.

Wooley et al. teaches a low pressure plasma created in an evacuable chamber to deposit a coating on plastic films. In Claim 1 of Wooley et al., one of the elements is "an evacuable chamber." At column 1, lines 42-44, Wooley et al. state: "When the gases flow towards the web at relatively low pressures, these gases form a plasma." Low pressures are discussed at many locations within the Wooley et al. patent. That is because for the Wooley et al. apparatus to function at all, low pressures are required. Atmospheric pressure is thousands of times higher than the low pressures employed in Wooley et al.

With the present invention, there is no need for an evacuable chamber or vacuum pumps. To better describe the present invention, Claims 1 and 9 again have been amended to clarify that atmospheric pressure exists in the interior space and that an inert gas is the majority gas.

Twice amended Claims 1 and 9 now more clearly indicate the nature of the plasma created by the present invention at atmospheric pressure. Since Wooley et al. teach a reduced-pressure enclosure and plasma, and do not teach an inert gas as a majority element of its gas, it cannot anticipate the claims of the present invention. Therefore the Examiner's rejection cannot stand.

The Examiner, in Paragraph 9, states that 13.56 MHz is the FCC required frequency for operation of plasma processors. This is not the case. The FCC has designated several frequencies for industrial uses, with 13.56 MHz being only one. Among the others are 60 Hz, 120 Hz, 50 KHz, 27 MHz, and 2450

MHz. The applicants, however, have found that the 13.56 MHz frequency provides a uniform and stable operation of the atmospheric pressure plasma using helium or other inert gases as the majority process gas. To date, the applicants have found that frequencies of 2 MHz and 27 MHz also provide stable operation of the present invention, as alluded to in applicants' specification. In any case, the use of AC power does not teach or suggest applicants' use of RF energy.

In his paragraph 12, the Examiner argues that because Wooley et al. disclose a gas made up of an inert gas and a chemically reactive gas that this covers an element of applicants' claims. This is not the case. As now amended, Claims 1 and 9 make it clear that the inert gas is the majority gas in the mixture. This type of mixture is important to the operation of the present invention at atmospheric pressure. However, such a majority is not necessary for low-pressure plasmas as taught by Wooley et al.

Similarly, in paragraph 13, the Examiner asserts that Wooley et al. teach helium as the inert gas and oxygen as a component of the reactive gas. Once again, Wooley et al. have no teaching or suggestion that helium is the majority of the gas. The Examiner then argues that the gas and the atmospheric pressure operation of the present invention are statements of intended use. However, he provides no corroboration for these assertions. Certainly, Wooley et al. provides no such teaching or suggestion, since Wooley et al.'s apparatus would not and could not operate at atmospheric pressure. Of course, applicants' claims, as amended, clearly distinguish over Wooley et al. in other areas, as well.

For a patent such as Wooley et al. to be an effective §102(b) reference, it must teach each element of the present application's claims. As shown, Wooley et al. fails to accomplish this and fails as such a reference. Therefore, the Examiner's rejection cannot stand.

Claims 2-6 and 10-15 depend from Claims 1 and 9. As twice amended Claims 1 and 9 now are considered to be allowable, the Examiner's rejection of dependent Claims 2-6, and 10-15, also cannot stand.

The Examiner next rejected Claims 1-6 under 35 U.S.C. §103(a) as being unpatentable over Fales (U.S. Patent No. 3,959,104) in view of Wooley et al. (U.S. Patent No. 5,743,966). The applicants respectfully traverse this rejection.

The Examiner states that Fales operates at "low frequency," but again states that 13.56 MHz is the FCC required frequency of operation. Applicants' have dealt with this assertion above and direct the Examiner's attention thereto. In any case, amended Claim 1 does not specify a frequency. Actually, Fales at Column 4, lines 49-50 and at Column 5, line 3, states that either AC or DC current may be used. The low or no frequencies of Fales certainly teach away from the RF energies employed with the present invention.

In paragraph 3, the Examiner argues that Fales teaches a gas comprised of an inert gas and a chemically reactive gas. However, Fales neither teaches nor suggests a gas comprised of a majority of inert gas with a chemically reactive gas. The Examiner then, in paragraph 4, alleges that Fales teaches a low flow rate of the gas. Applicants' review of Fales has discovered no teaching at all of any flow rate of the gas, with item 108 being a vacuum pump and item 109 being the gas inlet in Figure 10. See Column 7, lines 18-22.

The Examiner, in paragraph 5, asserts that, as described in applicants' Claim 3, Fales teaches that the inert gas is helium and the chemically reactive gas contains oxygen. However, Fales fails to teach that the inert gas is the majority component of the gas mixture. The Examiner then reasserts his argument that the RF frequency and the atmospheric pressure operation are statements of intended. Applicants reassert their previous response to this argument and also point out that these limitations are necessary for proper operation of the present invention and are not intended uses. Applicants also reassert that Fales teaches away from atmospheric pressure operation.

The Examiner further alleges that it would have been obvious to one of ordinary skill in the art at the time applicants' invention was made for Fales to connect his AC power between the electrically conductive enclosure and the electrode as taught by Wooley et al. Applicants cannot understand this

combination because the teachings of Fales appear to require the connection of the AC between interleaved electrodes that are isolated from the grounded enclosure. However, this is not overly important because even with Wooley et al. combined with Fales, there is no atmospheric pressure plasma processor operation in the RF range where the gas used has a majority amount of an inert gas. Because of this, the Examiner's rejection cannot stand.

Fales, like Wooley et al., teaches an evacuated enclosure for production of a plasma. Fales neither teaches nor suggests operation at atmospheric pressure. In fact, Fales teaches away for atmospheric pressure operation (Col 2, lines 27-50). As stated above, Wooley et al. also fails to teach or suggest atmospheric pressure operation, so that its combination with Fales cannot render applicants' claims, as amended, obvious. Also neither Fales nor Wooley et al. teaches an atmospheric pressure plasma having uniform glow properties. As stated previously, Claim 1 has been amended herein to clearly indicate the atmospheric pressure nature of the plasma created by the present invention. Thus the Examiner's rejection of Claim 1 cannot stand.

Claims 2-6 depend from Claim 1, as amended. These claims are now considered to be allowable, particularly with the current amendment of Claim 1.

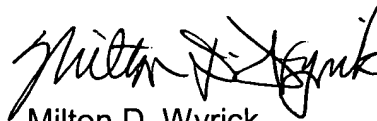
Again, the applicants appreciate the Examiner's indication that Claims 7, 8, 16, and 17 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. However, as applicants feel that all claims in this case should be allowable, no rewriting of these claims is necessary at this time. Should the Examiner not agree, the applicants would respectfully request that their attorney be notified as soon as possible so that an interview might be arranged.

Herein, Claims 1, 3, 9 and 12, and the specification have been amended to overcome the Examiner's rejections under 35 U.S.C. §102(b) and §103(a), and to more particularly claim the present invention in a sincere effort to move this case to allowance. For the reasons stated, and for other reasons inherent

herein, the Wooley et al. and Fales references, either alone or in combination, fail to anticipate, teach or suggest the novel aspects of the present invention as disclosed and set forth in applicants' claims as amended. Because of this, Claims 1-17, as amended, are considered to be allowable.

Therefore, this application is considered to be in condition for allowance, and such action is earnestly solicited.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Milton D. Wyrick", written in a cursive style.

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Dated: February 14, 2003

**MARKED UP VERISONS OF THE AMENDED CLAIMS
AND AMENDED PARAGRAPH OF THE SPECIFICATION**

IN THE CLAIMS:

Claim 1 (Twice Amended) Apparatus for processing materials in an atmospheric pressure radio-frequency non-thermal plasma comprising:

an electrically conductive enclosure defining and interior space with a surface and openings for introductions of a gas and for entry and exit of a material to be processed;

an electrode situated inside said interior space and spaced apart from said surface of said interior space a distance sufficient to allow placement of said material to be processed while said interior space is at or near atmospheric pressure ;

a mechanical action for placing said material to be processed inside said interior space on said electrode or between said electrode and said electrically conductive enclosure;

wherein a gas containing a majority of inert gas is introduced into said interior space through said opening for introduction of a gas and a radio-frequency voltage applied between said electrically conductive enclosure and said electrode creates an atmospheric pressure plasma in said interior space for processing said material to be processed within said electrically conductive enclosure.

Claim 3 (Amended) The apparatus as described in Claim 1, wherein said gas is comprised of [an] said inert gas and a chemically reactive gas.

Claim 9 (Twice Amended) Apparatus for processing materials in an atmospheric pressure radio-frequency non-thermal plasma comprising:

an electrically conductive enclosure defining an interior space with a surface and inlets for a gas and for entry and exit of a material to be processed while said interior space is at or near atmospheric pressure ;

an electrode spaced apart from said electrically conductive enclosure and capable of placing said material to be processed inside said interior space between said electrically conductive enclosure and said electrode, said material to be processed being in contact with said electrode;

wherein a gas containing a majority of inert gas is introduced into said inlet for gas and a radio-frequency voltage applied between said electrically conductive enclosure and said electrode creates an atmospheric pressure plasma in said interior space for processing said material to be processed as it passes through said electrically conductive enclosure.

Claim 12 (Amended) The apparatus as described in Claim 9, wherein said gas is comprised of [an] said inert gas and a chemically reactive gas.

IN THE SPECIFICATION:

Page 9, lines 15-28: It is important to note that inasmuch as the present invention utilizes RF energy to create a plasma and to process materials, electrically conductive enclosure 11 does not necessarily need to be grounded. In some circumstances it may be desirable to have electrically conductive enclosure 11 floating and apply RF energy 15 at some predetermined phase, which can differ by as much as 180°, with respect to RF energy 16 applied to electrode 13, to enhance the effectiveness of the processing. In this situation, a protective, grounded casing 14, shown by dashed lines in Figure 1, would enclose the invention for safety reasons. An appropriate frequency for the RF energy used in the present invention is 13.56 Megahertz (MHz), however other RF frequencies might also prove useful.